

## **Health Consultation**

### **Review of Surface Water and Sediment Data**

**Amoco–Sugar Creek  
(A.K.A. Amoco Oil Company)  
EPA Facility ID: MOD007161425  
Sugar Creek, Missouri**

*Prepared by*

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## List of Acronyms and Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
BTEX	Benzene, toluene, ethyl benzene, and xylenes
CREG	Cancer risk evaluation guide
CV	Comparison value
EFR	Enhanced fluid recovery
EMEG	Environmental media evaluation guide
EPA	Environmental Protection Agency
kg	Kilogram
MDOH	Missouri Department of Health
MDNR	Missouri Department of Natural Resources
mg	Milligram
MTBE	Methyl tertiary butyl ether
PAHs	Polycyclic aromatic hydrocarbons
ppb	Parts per billion
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SVOCs	Semi-volatile organic compounds
TFE	Total fluids extraction
TPH	Total petroleum hydrocarbon
VOCs	Volatile organic compounds

# **1 Purpose and Health Issues**

The Missouri Department of Natural Resources (MDNR) asked the Agency for Toxic Substances and Disease Registry (ATSDR) to evaluate the public health significance of surface water and sediment sampling data from areas on and near a former petroleum refinery, the Amoco Oil Company site, in Sugar Creek, Missouri. Residents of the Norledge neighborhood of Sugar Creek, an area adjacent to the southern boundary of the site, are concerned that off-site migration of contaminants could be adversely affecting their health and environment. The Norledge area of Sugar Creek comprises approximately 130 residences. In July 1999, MDNR collected surface water and sediment data from areas within the surface water drainage routes from the former refinery site. ATSDR issued a health consultation evaluating these surface water and sediment data for public comment on August 28, 2000. This health consultation addresses the public comments received by ATSDR.

## **2 Background**

### **2.1 Site Description**

The Amoco Oil Company began petroleum refinery operations in Sugar Creek, Missouri, in 1904. Crude oil was brought in by pipeline from several states to produce gasoline, distillate fuels, jet fuels, residual fuels, asphalt, petroleum coke, liquified petroleum gases, sulfur, and polymers (TriTechnics Corporation 1995). Although petroleum refinery operations ceased in 1982, Amoco has continued to use portions of the site as a light oil petroleum product marketing terminal, a pipeline facility, and an asphalt receiving and processing center (TriTechnics Corporation 1995).

While the refinery operated, the site consisted of numerous process units. In addition to these process units, several storage tank areas existed. Leaded gasoline and naphtha were used onsite (EPA 2001b). Numerous spills and leaks occurred throughout the site.

## **2.2 Land Use**

The Amoco site occupies approximately 500 acres on both sides of Sugar Creek (Figure 1, Appendix A). The site is bounded to the north by the Missouri River, on the East Bluff and West Bluff by wooded areas, and to the south by residential areas (TriTechnics Corporation 1995). The Atchison Topeka & Santa Fe and Missouri Pacific railroad lines run through the northern portion of the site.

## **2.3 Demographics**

According to the 2000 U.S. Census of Population and Housing (Bureau of the Census 2001), the demographic statistics for locations within 1 mile of the Amoco site indicated 9,708 persons residing in 4,446 households. Of these, 92.2% were white; 1.4% were black; 0.7% were American Indian/Alaska Native; 0.6% were Asian; 1.0% were Native Hawaiian and Other Pacific Islander; 1.6% were members of other races; and 2.5% were members of two or more races. A total of 927 children were 6 years of age or younger, and 1,393 adults were 65 years of age and older (Figure 2, Appendix A).

## **2.4 Remediation and Sampling Activities in the Norledge Area**

Amoco refinery operations were regulated under the Resource Conservation and Recovery Act (RCRA). When refinery operations ceased, a RCRA Facility Investigation (RFI) identified potential sources, areas, and characteristics of contamination to be investigated (TriTechnics Corporation 1995). Since the 1995 RFI report was submitted, the Environmental Protection Agency (EPA) and MDNR have taken a different approach to completing the RFI process. Because of public concern, the agencies have focused most of the investigation in the off-site plume area. Amoco has since submitted an RFI report focused solely on the off-site plume area to expedite investigations and to implement cleanup activities in the offsite area. Subsequent investigations will be conducted in a phased manner for the remainder of the site (EPA 2001a).

Groundwater investigations have identified one off-site area of benzene contamination and two off-site areas of free product (that is, free-floating petroleum) contamination in the Norledge area (TriTechnics Corporation 1995). Amoco began efforts to recover free product in the late 1950s and to control migration of hydrocarbons dissolved in groundwater in the 1960s through construction of interceptor drain systems and trenches (TriTechnics Corporation 1995). This program was expanded in the 1970s and 1980s with the construction and expansion of the Norledge Interceptor Trench Recovery Network. In addition to the interceptor trench, interim measures include enhanced fluid recovery (EFR) and total fluids extraction (TFE) (BP 2002).

Amoco conducts biweekly EFR on wells in the Norledge area. During the EFR process, a vacuum truck is connected to each well to extract fluid and vapors. Free product is collected for recycling, contaminated groundwater is sent to a treatment system, and vapors are treated by activated carbon canisters. To maximize the effectiveness of the process, the locations of the EFR events are adjusted periodically (BP 2003). Since this EFR activity began, levels of contamination have decreased (EPA 2002). EFR has successfully assisted the natural attenuation of volatile organic compound (VOC) concentrations in groundwater; benzene concentrations have decreased (BP 2003). Monitoring wells located in the Norledge area are monitored and sampled quarterly. EFR will continue until a final corrective remedy is approved and installed (BP 2003).

The TFE system is similar to the EFR system in that fluids including groundwater, free product, and soil vapor are removed. Additionally, TFE stimulates the biodegradation of hydrocarbons by introducing oxygen through the subsurface (BP 2002). The TFE system consists of nine horizontal wells. The first two horizontal recovery wells were installed and pilot-tested in late 1999; seven additional horizontal wells started operations in early 2001. As of April 2002, the TFE system met shutdown criteria, and the Confirmation Monitoring Program began (BP 2003). Approximately 87,300 pounds of hydrocarbon were removed during the system's operation, with the greatest mass removal from biodegradation (68,600 of the 87,300 pounds) (BP2003).

According to a March 2004 corrective measures study, sources of petroleum hydrocarbons to Sugar Creek will be eliminated, including pollutants from contaminated groundwater and the impacted bank soil of Sugar Creek. Contaminated sediment will be remediated through a combination of attenuation and physical removal. Sugar Creek will be sampled semiannually to determine the progress of attenuation. Contaminated soils are collected and removed at the underflow weir located downstream of impacted areas. Any areas not attenuating will be physically removed. All contaminated sediment removed will be either deposited in the on-site special waste landfill or disposed of off-site as hazardous waste (MDNR 2004).

Underground pipelines also are being investigated. Starting in the 1970s, Amoco began to replace underground pipelines with above-ground pipelines to reduce the potential for undetected releases (TriTechnics Corporation 1995). (Amoco's active pipelines currently enter the site from the eastern and northern borders.) Two of Amoco's old product pipelines run through the Norledge area—one along Northern Street and one along Carlisle Street. Williams Natural Gas owns the pipeline that runs along Northern Street, and the line supplies natural gas to the local power plant. The line that runs along Carlisle Street was abandoned in the early 1980s (EPA 2001a). The decommissioned underground lines were flushed with water in 1986–1987. However, a leaking pipe in a tank dike indicated that some product remained in the lines after the flushing. EPA requested that Amoco prepare a plan for investigating underground pipelines. As part of future investigations, Amoco will address underground piping and other subsurface structures (EPA 2001b).

Although the sampling locations might have varied, Amoco analyzed on-site samples primarily for benzene, toluene, ethyl benzene, and xylenes (BTEX), as well as polycyclic aromatic hydrocarbons (PAHs) and metals in soils, sludges, and groundwater in the 1980s and 1990s (EPA 2002). Sampling in the 1980s and early 1990s did not include sampling in the off-site areas. More recently, samples collected from on- and off-site areas are analyzed for a wider suite of

chemicals. Overall, remedial activities in the Norledge area should decrease contaminant concentrations in the future.

## **2.5 July 1999 Environmental Data**

On July 8, 1999, MDNR collected 13 surface water samples (grab samples), one duplicate surface water sample (sample #994103), and three stream sediment samples (grab samples) (MDNR 1999). All samples were submitted for analyses of metals, semivolatile organic compounds (SVOCs), and VOCs.

Twelve surface water samples were collected from 11 on-site locations and two sediment samples were collected from two on-site locations. On-site samples were taken in drainage areas located on the Amoco property. These samples were collected to evaluate potential contaminants in drainage areas that carry surface water northward, away from the Norledge neighborhood. The northern drainage areas empty into the Missouri River.

Two surface water samples were collected at two off-site locations (Sugar Creek near the intersection of Carlisle and Ohio streets, and the Elizabeth Street Tributary). One sediment sample was collected off-site in Sugar Creek near the intersection of Carlisle and Ohio streets.

## **3 Discussion**

ATSDR evaluates contaminants detected in environmental media at hazardous waste sites and determines whether an exposure to the contamination has public health significance. ATSDR begins this evaluation by reviewing environmental data to determine whether levels of contaminants are above health-based comparison values (CVs). Health-based CVs are media-specific concentrations of chemicals that are not likely to result in adverse health effects. However, not all chemicals have relevant CVs. Once the environmental data have been evaluated,



ATSDR determines whether people were, or continue to be, exposed to the contaminants (Appendix B).

Residents reported that children have played and continue to play in the creeks, although ATSDR does not know the extent to which this activity occurs. ATSDR staff determined that past, current, and future completed exposures to off-site surface water and sediment exist for Sugar Creek residents (Table 1, Appendix A). Additionally, past, current, and future potential exposures to on-site surface water and sediment exist for workers and trespassers. The most likely exposures are incidental ingestion and dermal contact because of intermittent (occasional) contact with the sediment and surface water. Inhalation exposures from the surface water and sediment were considered, but because the data for VOCs in the water and sediments were very low, significant inhalation exposures were unlikely and not evaluated further.

To simplify the discussion, the contaminant discussions are separated into two groups according to the direction of the two drainage systems. For this health consultation, those drainage systems are defined as (1) the “Northern On-Site Drainage Areas,” which drain the surface of the Amoco property and are routed into the Missouri River, and (2) the “Sugar Creek Area Drainage,” which carries water through the Sugar Creek neighborhood and from there through the Amoco property to the Missouri River.

### **3.1 Northern On-Site Drainage Areas**

None of the detected metals, VOCs, or SVOCs in on-site surface water and sediment samples collected in the northern drainage areas were found at a level that exceeded health-based CVs (ATSDR’s cancer risk evaluation guide [CREG] and environmental media evaluation guide [EMEG] values). Intermittent exposures to these levels of contaminants for workers and trespassers are not expected to result in adverse health effects.

ATSDR has no CV for total petroleum hydrocarbon (TPH) in sediment. The maximum concentration of TPH in sediment was 2,440 parts per million. This concentration was detected in the drainage area on the northern portion of the former refinery site and downstream of the residential neighborhoods. TPH is not expected to migrate “upstream” through the surface water into residential neighborhoods. As stated in Section 2.4, contaminated sediment will be remediated through a combination of attenuation and physical removal.

### **3.2 *Sugar Creek Drainage Area***

With one exception, as noted below, none of the detected metals, VOCs or SVOCs in the two surface water samples and one sediment sample collected off-site were found at levels that exceeded health-based CVs (ATSDR’s CREG and EMEG values).

Benzo(a)pyrene was detected in the one sediment sample collected from Sugar Creek near the intersection of Carlisle and Ohio streets (sample #994116). Benzo(a)pyrene is a common environmental contaminant produced by natural events as well as human activities. Common sources of benzo(a)pyrene include residues from forest fires, burning of wood in homes, combustion of fuels in automobiles, and residues on food that has been cooked over an open fire or grill (ATSDR, 1995). The source for the benzo(a)pyrene found in this one sample is unknown.

The benzo(a)pyrene found in this sediment sample, at 280 parts per billion (ppb), exceeded an ATSDR health-based CV (CREG of 100 ppb). While above the CV, an intermittent (or occasional) exposure (either incidental ingestion or dermal contact) to this level of benzo(a)pyrene is not likely to result in an elevated risk for cancer. In addition, such an intermittent exposure would not be likely to result in adverse noncancer health effects.

The off-site data ATSDR reviewed for this health consultation were limited. ATSDR previously recommended, in the public comment release version of this health consultation, further characterization to determine whether levels found in these samples truly represent these media.

This further characterization included the collection of soil and sediment samples along the banks of Sugar Creek and in drainage and seep areas. Surface water samples also were collected from Sugar Creek and from drainage and seep areas. The results of these additional samples indicate that exposure to the detected levels of contaminants, including benzo(a)pyrene, are not likely to result in adverse health effects (see Section 7). Because ATSDR's conclusions have not changed on the basis of the additional data, ATSDR has updated the recommendation section of this health consultation to state "ATSDR has no specific recommendations at this time" (see Section 6).

## **4 Child Health Considerations**

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Because children are shorter than adults, they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate result in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children depend entirely on adults for access to housing and medical care and for risk identification. Thus, adults need as much information as possible to make decisions regarding their children's health.

Because children live in Sugar Creek, ATSDR considered possible exposure scenarios to children while evaluating the surface water and sediment data that MDNR submitted for the site. ATSDR does not know the specific activity patterns of area children, but residents reported that children play occasionally in the creeks. The data reviewed in this and subsequent health consultations indicated that intermittent exposures to off-site surface water and sediment in Sugar Creek and the drainage and seep areas are not likely to cause adverse health effects. Although chemical levels are below levels known to result in adverse health effects, parents should caution their children not to routinely play in these areas as a prudent public health measure.

## 5 Conclusions

The limited data provided to ATSDR for this health consultation indicate that intermittent exposures to off-site surface water and sediment are not a public health threat to residents living in Sugar Creek. Intermittent exposures to on-site surface water and sediment would not be expected to result in adverse health effects for workers and trespassers. Remedial activities in the Norledge area should result in a decrease in contaminant concentrations in the future. ATSDR categorizes these exposures to surface water and sediment as presenting *no apparent public health hazard*<sup>1</sup>.

## 6 Recommendations

ATSDR has no specific recommendations at this time.

## 7 Public Health Action Plan

The actions described in this section are designed to ensure that this public health assessment identifies public health hazards and provides a plan of action to mitigate and prevent adverse health effects resulting from exposure to hazardous substances in the environment. In addition, the results of each ATSDR site-specific activity and evaluation are provided. Where applicable, ATSDR includes a commitment to follow up on this plan and ensure it is implemented.

### **Actions Completed:**

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<sup>1</sup> The phrase “no apparent public health hazard” is a formal conclusion category that ATSDR reserves for sites where human exposure to contaminated media is occurring, has occurred, or will occur, but the exposure poses no health hazard.

- May 3, 1999: ATSDR reviewed and provided comments to the Missouri Department of Health (MDOH) regarding "The Sugar Creek Cancer Inquiry Report–Level 2 Investigation, March 23, 1999."
- May 7, 1999: ATSDR released its first public health assessment for public review and comment. ATSDR concluded in the initial public comment version that the Norledge area of Sugar Creek poses an *indeterminate public health hazard*<sup>2</sup> because only limited data for indoor air were available, and no data for surface soil were available. ATSDR's recommendations included sampling indoor air and surface soil.
- May 1999: ATSDR released an easy-to-understand fact sheet summarizing our findings from the May 1999 public health assessment document. This fact sheet was included as an insert in the *Sweet Talk* newsletter released in June 1999.
- June 2, 1999: ATSDR conducted a public meeting and public availability sessions during the comment period of the May 1999 public health assessment to address questions about the document and to collect additional community concerns.
- September 1999: ATSDR published an article in *Sweet Talk* to update residents on its activities in the Sugar Creek Community.
- March 29, 2000: ATSDR released a public health assessment addendum for public review and comment. ATSDR determined current, chronic exposures to the contaminant levels detected in indoor air are not likely to be associated with adverse health effects.
- April 2000: ATSDR released an easy-to-understand fact sheet summarizing its findings from the March 2000 public health assessment addendum. This fact sheet was included as an insert in *Sweet Talk*, released in May 2000.
- April 12, 2000: ATSDR released a health consultation, "Review of January 2000 Air Data," for public review and comment. ATSDR determined that the contaminant levels detected during an indoor air sampling event are not likely to be associated with adverse health effects.
- May 1, 2000: ATSDR released a health consultation, "Review of February 2000 Soil Data," for public review and comment which evaluated Norledge area surface soil data provided by EPA. No adverse health effects would be expected from exposure to this soil during activities such as gardening or playing.

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<sup>2</sup> The phrase "indeterminate public health hazard" is a formal conclusion category that ATSDR reserves for sites at which, because of the unavailability of critical information, the existence or nonexistence of a potential threat to health in the community cannot be determined.

- June 27, 2000: ATSDR reviewed and provided comments to MDOH regarding “The Sugar Creek Cancer Inquiry Report—Level 3 Investigation, March 3, 2000.”
- August 28, 2000: ATSDR released this health consultation, “Surface Water and Sediment Data Review,” for public review and comment. On the basis of the data, ATSDR determined that exposures to off-site surface water and sediment contaminants are not a public health threat to residents in the Norledge neighborhood. However, because the data were limited at the time, ATSDR recommended additional surface water and sediment sampling in the off-site portions of Sugar Creek.
- November 29, 2000: ATSDR’s May 1999 public health assessment was released final and included its responses to comments received on the initial public comment version. ATSDR concluded that short-term exposures to the levels of contaminants detected in indoor air are not likely to be associated with adverse health effects. Potential intermittent exposures to subsurface soils also would be unlikely to result in adverse health effects. No exposures to groundwater were identified.
- December 8, 2000: ATSDR released a final health consultation, “Review of March 2000 Sediment and Surface Water Data,” which evaluated surface water and sediment data provided by the MDNR. On the basis of the data, ATSDR determined that exposures to on-site surface water and sediment in the tank berms and off-site surface water and sediment in the drainage ditch and seepage areas would not be expected to result in adverse health effects. However, because the data were limited at the time, ATSDR recommended additional off-site surface water and sediment sampling in the seepage area and the drainage ditch.
- December 8, 2000: ATSDR released a final health consultation, “Indoor Air in Two Residences in the Norledge Area,” which evaluated indoor air sampling data provided by the Amoco Oil Company. On the basis of a review of the data, ATSDR determined indoor air exposures to the levels detected would not be expected to produce adverse health effects.
- December 19, 2000: ATSDR released final a health consultation, “Review of 1996 Water and Soil Data,” which evaluated water and soil data from the Norledge area. On the basis of the data, ATSDR determined that exposures to water and soil by children playing in Sugar Creek should not result in adverse health effects. However, because the data were limited, ATSDR recommended additional surface water and sediment sampling in Sugar Creek.
- April 23, 2001: ATSDR released final a health consultation, “Review of October 2000 Soil and Surface Water Data,” which evaluated surface water and soil data provided by EPA. On the basis of the data, ATSDR determined that intermittent exposures to surface water and subsurface soil in Sugar Creek, and the seepage area would not be expected to result in adverse health effects.

- June 25, 2001: ATSDR released final a health consultation, “Review of Ambient Air Data,” which evaluated ambient (that is, outdoor) air sampling data collected by the MDNR. On the basis of a review of the data, ATSDR determined ambient air exposures in the Norledge area would not be expected to produce adverse health effects.
- November 19, 2001: ATSDR provided technical assistance by reviewing the results of one surface water and one soil sample collected at the intersection of Carlisle and Northern streets in Sugar Creek. ATSDR determined the water and soil samples indicated levels of chemicals that are unlikely to result in adverse health effects.
- September 17, 2002: ATSDR provided technical assistance to EPA by reviewing the results of surface water and sediment samples collected in Sugar Creek. On the basis of a review of the limited data, ATSDR determined that surface water and sediment samples indicated levels of chemicals that are unlikely to result in adverse health effects.
- May 20, 2004: ATSDR’s March 2000 public health assessment addendum was released final and included its responses to comments received on the initial public comment version. ATSDR determined current, chronic exposures to the contaminant levels detected in indoor air are not likely to be associated with adverse health effect.

**Actions Planned:**

ATSDR will evaluate additional environmental data for the Norledge area for public health significance, upon request. Results of these evaluations will be provided to the public in subsequent ATSDR documents.

## **8 Public Comment**

ATSDR released this health consultation for public review and comment from August 28, 2000, through October 10, 2000. Appendix C contains both the comments received during the public comment period and ATSDR’s responses to those comments.

## **9 Preparers of Report**

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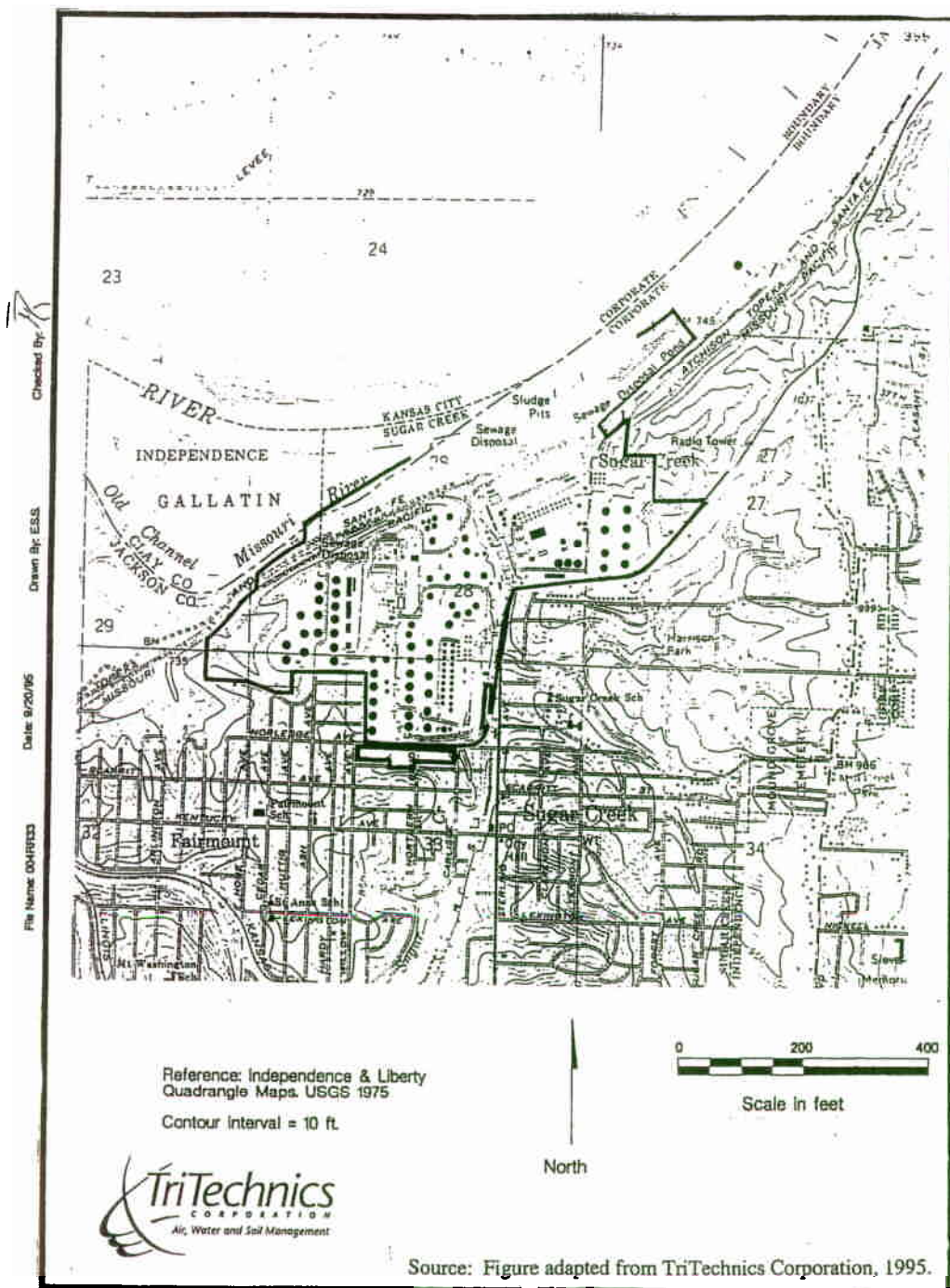
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## **Appendix A – Figures and Tables**

**Figure 1: Amoco Oil Company Site Location Map**



# Amoco Oil Company

## Sugar Creek, Missouri

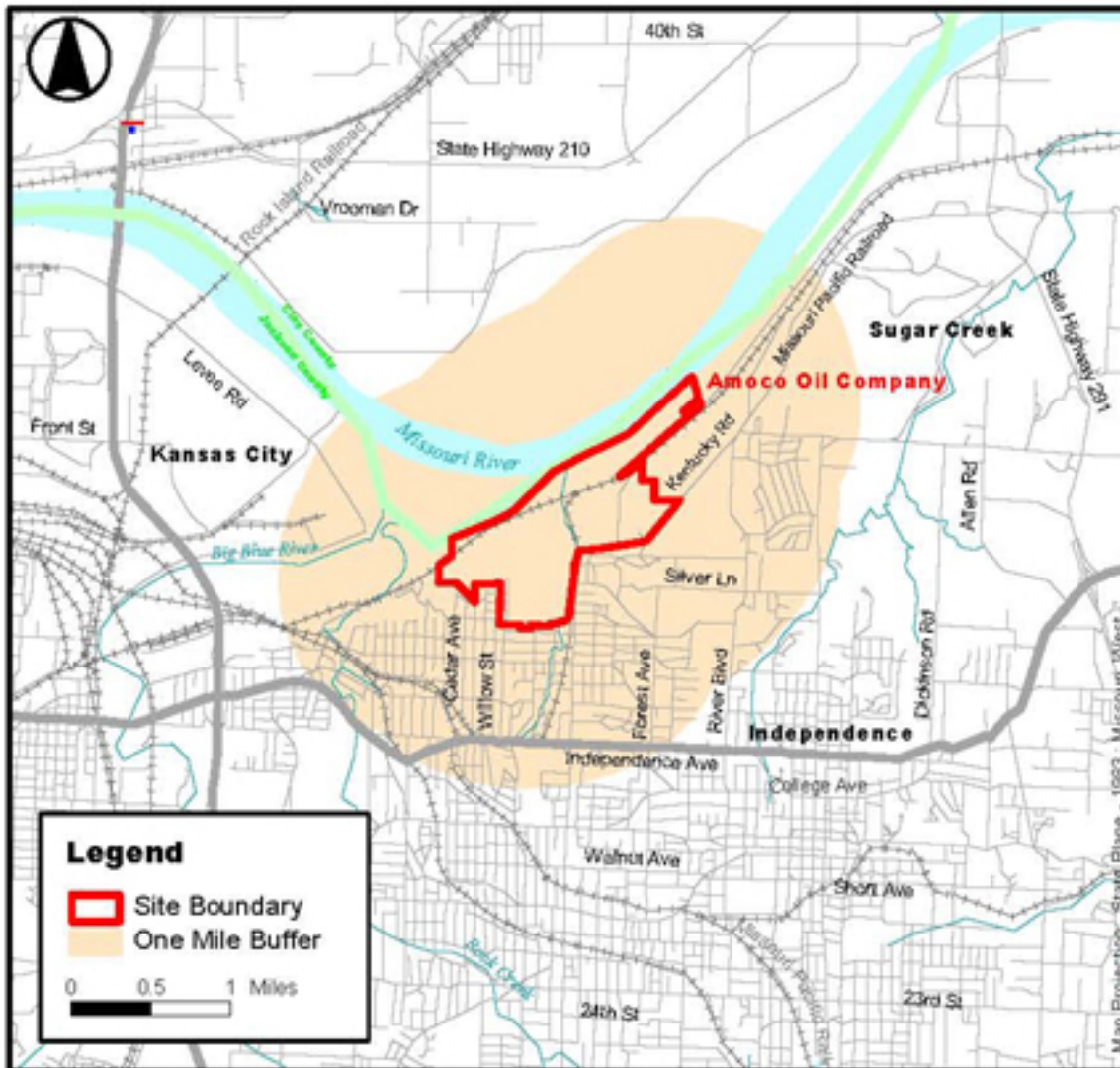
EPA Facility ID MOD007161425

# INTRO MAP

Site Location



## Jackson County, Missouri



Base Map Source: 1995 TIGER/Line Files

### Demographic Statistics Within Area of Concern\*

Total Population	9708
White alone	8952
Black alone	137
Am. Indian and Alaska Native alone	68
Asian alone	62
Native Hawaiian and Other Pacific Islander alone	96
Some other race alone	159
Two or More races	238
Hispanic or Latino	383
Children Aged 6 and Younger	927
Adults Aged 65 and Older	1393
Females Aged 15 - 44	1933
Total Housing Units	4446

Demographics Statistics Source: 2000 US Census  
\*Calculated using an area-proportion spatial analysis technique

### Population Density

Source: 2000 U.S. Census



### Children 6 Years and Younger

Source: 2000 U.S. Census



### Adults 65 Years and Older

Source: 2000 U.S. Census



### Females Aged 15 - 44

Source: 2000 U.S. Census



**Table 1: Exposure Pathway Elements**

Pathway Name	Exposure Pathway Elements					Time Frame
	Source	Media	Point of Exposure	Route of Exposure	Exposed Population	
Completed Exposure Pathways						
Surface Water	Unknown	Off-Site Surface Water	Sugar Creek; Elizabeth Street Tributary	Dermal; Incidental Ingestion	Residents	Past; Current; Future
Sediment	Unknown	Off-Site Sediment	Sugar Creek; Elizabeth Street Tributary	Dermal; Incidental Ingestion	Residents	Past; Current; Future
Potential Exposure Pathways						
Surface Water	Amoco and Other Sources	On-Site Surface Water	Sugar Creek	Dermal; Incidental Ingestion	Workers, Trespassers	Past; Current; Future
Sediment	Amoco and Other Sources	On-Site Sediment	Sugar Creek	Dermal; Incidental Ingestion	Workers, Trespassers	Past; Current; Future

## **Appendix B – ATSDR Methodology**

### **ATSDR Methodology**

ATSDR addresses the question of whether exposure to contaminants at the maximum concentrations detected would result in adverse health effects. While the relative toxicity of a chemical is important, the human body's response to a chemical exposure is determined by several additional factors, among which are

- the concentration (how much) of the chemical to which the person was exposed,
- the amount of time the person was exposed (how long), and
- the way the person was exposed (through breathing, eating, drinking, or direct contact with something containing the chemical).

Lifestyle factors (for example, occupation and personal habits) have a major impact on the likelihood, magnitude, and duration of exposure. Individual characteristics such as age, sex, nutritional status, overall health, and genetic constitution affect how a human body absorbs, distributes, metabolizes, and eliminates a contaminant. A unique combination of all these factors will determine the individual's physiologic response to a chemical contaminant and any adverse health effects the individual may suffer as a result of the chemical exposure.

ATSDR evaluates contaminants detected in environmental media at a site and determines whether an exposure to them has public health significance. ATSDR begins this evaluation by gathering reports that contain relevant environmental data for the site. These data are reviewed to determine whether contaminant levels are above health-based comparison values. Health-based comparison values are estimates of the daily human exposure to a substance that are not likely to result in adverse health effects over a specified duration of exposure. These values are developed for specific media (such as air and water) and for specific durations of exposure (such as acute and chronic).

Comparison values represent conservative levels of safety and not thresholds of toxicity. Thus, although concentrations at or below a comparison value may reasonably be considered safe, concentrations above a comparison value will not necessarily be harmful. Comparison values are intentionally designed to be much lower, usually by orders of magnitude, than the corresponding no-effect levels (or lowest-effect levels) determined in laboratory studies to ensure that even the most sensitive populations (such as children or the elderly) are protected.

To determine whether people are being exposed to contaminants or whether they were exposed in the past or will be exposed in the future, ATSDR examines the path between a contaminant and a person or group of people who could be exposed. Completed exposure pathways have five required elements. ATSDR evaluates each possible pathway at a site to determine whether all five



factors exist and people are being exposed, were exposed, or may be exposed in the future. These five factors or elements must exist for a person to be exposed to a contaminant:

- (1) a source of contamination
- (2) transport through an environmental medium
- (3) a point of exposure
- (4) a route of human exposure, and
- (5) an exposed population.

ATSDR classifies exposure pathways in one of the following three categories.

- *Completed Exposure Pathway.* ATSDR calls a pathway “complete” if it is certain that people are exposed (or were exposed or will be exposed) to contaminated media. Completed pathways require that the five elements exist and indicate that exposure to the contaminant has occurred, is occurring, or will occur.
- *Potential Exposure Pathway.* Potential pathways are those in which at least one of the five elements is missing, but could exist. Potential pathways indicate that exposure to a contaminant could have occurred, could be occurring, or could occur in the future.
- *Eliminated Exposure Pathway.* In an eliminated exposure pathway, at least one of the five elements is missing and will never be present. From a human health perspective, pathways can be eliminated from further consideration if ATSDR is able to show that (1) an environmental medium is not contaminated or that (2) no one is exposed to contaminated media.

## **Appendix C – Public Comments**

## Appendix C: Public Comments

ATSDR released this Amoco Oil Company surface water and sediment data review health consultation for public review and comment from August 28, 2000, through October 10, 2000. Each comment received was logged and became part of the administrative record. This appendix contains both the comments received during the public comment period and ATSDR's response to those comments.

**Comment 1:** In Section 1 of the public comment version of this health consultation, you note that only one off-site sample, located in the “Norledge Neighborhood,” was taken. This is incorrect and extremely misleading. It is your business, in protecting the health of residents, to be clear and specific. In fact, the sample you describe as located in the “Norledge Neighborhood,” along Sugar Creek, is actually Sample #994116, which was a sediment grab taken from Sugar Creek at Ohio and Carlisle. This is *not* what would be considered the “Norledge Area.” Also, another sample (water sample #994116)—NOTE one + one = *two* samples, was also taken from Sugar Creek at Ohio and Carlisle. Another sample (#994110) was taken at the Elizabeth Street Tributary. It is unclear as to whether this was located on or off the refinery. You should make this clear in your report.

**Response 1:** In Section 1 of the public comment version of this health consultation, ATSDR specifically noted “at one off-site sample *location*.” However, as the commenter notes, *two samples* were collected, but they both were collected from that one sample *location* (i.e., in Sugar Creek near the intersection of Ohio and Carlisle streets). Because of the confusion caused by this statement in Section 1, the statement was deleted from the final version of this health consultation. Also, ATSDR added a new section to clarify the number of samples and sample locations (see Section 2.5).

ATSDR reviewed a map showing the location of sample #994110, a water grab sample from the Elizabeth Street Tributary, and it appears to be off the refinery site. As requested, this has been clarified in the text of the health consultation.

**Comment 2:** We request that you acknowledge in Section 2 the fact that, until very recently, many refinery contaminants were not included in the investigation as a priority.

**Response 2:** Although the sampling locations might have varied, Amoco analyzed on-site samples primarily for BTEX, as well as for PAHs and metals in soils, sludges, and groundwater in the 1980s and 1990s (EPA 2002). Sampling in the 1980s and early 1990s, however, did not include the off-site areas. ATSDR acknowledges that testing of contaminants in the 1980s and early 1990s focused on BTEX. More

recently, however, samples collected from on- and off-site areas were analyzed for a wider suite of chemicals (see Section 2.4).

Comment 3: The RCRA Facility Investigation (RFI) has yet to be completed, “characterization” has been left to the polluter, and ineffective Interim Measures (IM) are the only activities taking place. According to EPA, another “off-site” RFI is being considered. If the first RFI has yet to be completed, it is unknown when the second will ever be addressed. We have asked for Superfund since day one. These are important issues that have been left out of your health consultations.

Response 3: Since the 1995 RFI report was submitted, EPA and MDNR have taken a different approach to completing the RFI process. Because of public concern, the agencies have focused most of the investigation in the off-site groundwater plume area. Amoco has since submitted an RFI report focused solely on the off-site plume area to expedite investigations and to implement cleanup activities in the off-site area. Subsequent investigations will be conducted in a phased manner for the remainder of the site (EPA 2001). ATSDR provided additional text in the health consultation about remediation activities (see Section 2.4).

Comment 4: In Section 2, you indicate that “Starting in the 1970s, Amoco began to replace underground pipelines with above-ground pipelines to reduce the potential for undetected releases.” There is no evidence that this ever occurred prior to the refinery’s closure in 1982. In fact, Amoco claims that they do not even know where all of the old underground lines are. An Amoco expert witness testified that it would be extremely difficult for Amoco to find abandoned, seeping underground pipelines because accurate maps don’t exist and knowledgeable personnel aren’t available. BP Amoco has not yet volunteered to implement a metal-detection system to find all these pipes, which would resolve many of these issues.

Response 4: ATSDR provided additional text in the health consultation about remediation activities, which includes information about the underground pipelines (see Section 2.4).

Comment 5: The report should clarify the location of Amoco’s active pipelines (as mentioned in Section 2). The report states “*active and inactive underground pipelines currently run throughout many portions of the site.*” This could lead the reader to believe that active petroleum product pipelines are located throughout the site, when actually they are located only in the vicinity of the active pipeline and marketing terminals in the northeast portion of the Former Refinery. In addition,

the active pipelines enter the site from off-site on the eastern and northern borders of the site.

Response 5: The ambiguous statement was removed. In addition, ATSDR provided text in Section 2.4 about the location of the underground pipelines.

Comment 6: You note that there are approximately 100 residences. We take exception to the inaccuracy of your report. Residential areas that are affected are not limited to the street of Norledge. There are residences all along the southern boundary of the refinery, and we have found signs of pollution to the east, west, and north of the site, far from Norledge Avenue. You should be specific about the areas affected because it includes residents of Independence, too. Also, in prior comments on your health assessments, you have been told that the number of residences are closer to 130, *not* 100. It is clear to us, that you are recycling sections of your reports without taking into consideration the comments you have received from the public you are supposed to be protecting. In fact, we have yet to receive any response from your agency in regards to our diligent efforts to comment on your reports.

Response 6: Background information in this health consultation has been updated. Although responses to comments sometimes may be delayed, all comments received by ATSDR are considered. ATSDR sincerely apologizes for the delays in responding to public comments with regard to the Amoco site. The number of homes in the Norledge area has been changed to 130 (see Section 1).

Comment 7: In Section 3, not only are the data you are using substantially limited, but there are additional sampling data (i.e., MDNR's March 2 and 3, 2000, report; Dr. Sayad Hasan's data on heavy metals, released in March 2000) available to you which went unused for this report. We find it extraordinary that you are just now writing a report on July 1999 data and ignore critical March 2000 data. The reports include soil, water, and sediment samples both on- and off-site. The March 2000 reports demonstrate that there are high levels of various contaminants on-site. We know that these are migrating off-site into residential neighborhoods through multiple pathways/drainage's. There are examples in both reports of contaminants that were found at high levels on-site as well as off-site. This indicates that there is migration.

Response 7: This health consultation was undergoing management review when ATSDR received the March 2000 data and was released before the March 2000 data were evaluated for public health significance. However, the March 2000 data were

evaluated in a separate health consultation released on December 8, 2000. In the December 2000 health consultation, ATSDR determined current exposures should not result in adverse health effects (see Section 7).

Comment 8: In Section 3 of the public comment health consultation, the number of samples collected on July 8, 1999, is listed as 13 surface water samples and 3 stream sediment samples, totaling 16 samples. You account for only 11 samples. What happened to the other 5 samples? Were they considered in this report? Or is this just another typo? ATSDR has a duty to be specific and accurate at all times. These are people's lives you're dealing with.

Response 8: Please see Response 1. There is confusion between how many *samples* were collected and how many *sample locations* exist. ATSDR modified statements in Section 3 and added a section (see newly created Section 2.5) to clarify the sampling event.

Comment 9: You state that "Residents reported that children have played and continue to play in Sugar Creek, although ATSDR does not know the extent to which this activity occurs." When we reported this activity to Denise Jordan-Izaguirre, showed her the kids' swimming hole, and asked her to do something to stop children from being exposed in the creek, she said that any warning like that might result in more children swimming in the creek. Although we disagreed and felt that ATSDR has a responsibility to warn the public, she suggested that a warning be placed in *Sweet Talk*, a City of Sugar Creek publication. This warning never appeared in *Sweet Talk*, nor was anyone from the City of Independence warned. We continue to see children near, in, and around the creek. You knew/know full well the extent to which "this activity" was (and is) occurring. Therefore, you cannot say that past, current, and future completed exposures are "*incidental ingestion and dermal contact due to intermittent (occasional) contact with the sediment and surface water.*" You also note that "*inhalation exposures are unlikely and not evaluated further.*" As you admit, the data are substantially limited, and therefore such a conclusion is meaningless.

Response 9: ATSDR evaluates available data for public health significance. When those data are limited, ATSDR may recommend the collection of additional data to confirm ATSDR's initial conclusions. The public comment version of this health consultation recommended collection of additional samples. ATSDR reviewed these additional data for off-site surface water and sediment in subsequent health consultations (see Section 7). ATSDR's conclusions—specifically that current exposures should not result in adverse health effects—have not changed. Because

the additional data have not changed our conclusions, ATSDR has updated the recommendation section of this health consultation to state “ATSDR has no specific recommendations at this time” (see Section 6).

ATSDR reaffirms that completed exposure to surface water and sediment occurs intermittently through incidental ingestion and dermal contact only. As defined by ATSDR, chronic conditions of exposure would refer to daily exposure all year. Chronic exposure would not occur during the winter. For chronic exposure, ATSDR assumes that the average 70-kilogram (kg) adult consumes 2 liters of water and 100 milligrams (mg) of soil and breathes about 20 liters of air every day. For a 10-kg child, the corresponding defaults are 1 liter of water, 200 mg of soil, and less than 10 liters of air, every day. For Sugar Creek residents (adults and children), these default chronic conditions of exposure to surface water and sediment are unlikely. For example, adults are unlikely to be consuming 100 mg and children are unlikely to be consuming 200 mg of creek sediment every day, all year. Therefore, ATSDR defined the exposure as “intermittent (occasional).”

**Comment 10:** A local resident supplied daily ambient air odor reports, in excess of 300 days. Often, odors/vapors are detected coming out of the ground as well as off the creeks. There are large areas in the residential neighborhood that consistently reek of petroleum. This local resident is one of many residents who have reported such odors. This indicates to us that there are exposures from soil gases. The community reports suggesting this have been ignored. The local resident began these reports because she was told by regulatory and health agencies that there was not enough information about petroleum odors in her neighborhood. All of her odor reports should be considered in your Public Health Assessment as a data reference source.

**Response 10:** EPA and MDNR established standard operating procedures in response to odor concerns. The preferred first responder is the Sugar Creek Fire Department. To collect initial field screening information during odor events, the fire department has a combustible gas indicator and a photo ionization detector (PID).

ATSDR responded to requests to review chemical-specific environmental data and did so through a series of public health assessments and health consultations (see Section 7). This health consultation focused solely on the July 1999 sampling event involving surface water and sediment.

**Comment 11:** Moreover, unlike EPA Region 1, the EPA’s and MDNR’s investigation of the inhalation exposure pathway has been limited to minimal in-house basement air

sampling. EPA Region 1 is directly testing for the presence of VOCs in subsurface soil using an underground trench system and sophisticated monitoring equipment. Because EPA Region 7, the MDNR, and ATSDR did not truly believe a potential hazard currently exists, these agencies have never required or conducted this type of soil gas sampling.

Response 11: Because soil gas measurements can be evaluated only to determine the extent to which contaminated groundwater might affect the air pathway, ATSDR prefers to review sampling data collected directly from the air pathway. However, ATSDR previously reviewed data on 35 soil-gas samples collected primarily from the Norledge area in the November 2000 public health assessment. Because BTEX were detected in soil gas, ATSDR had recommended additional indoor air sampling. ATSDR reviewed the additional indoor air data and determined exposures are not at levels of health concern.

At this time, ATSDR has no plans to request additional soil vapor or indoor air sampling data. Given remedial measures, including enhanced fluid recovery (EFR) and total fluids extraction (TFE), soil gas levels should be decreasing. Therefore, any potential contribution from the soil vapor media to air levels should decrease as well.

Comment 12: It should also be noted that the potential exists that Amoco's EFR and horizontal well processes could expose residents to more emissions. Although the potential exposure may be accidental, the concentrations of VOCs in the subsurface water would be significantly higher than those found in the MDNR's samples of surface water.

Response 12: As stated previously, this health consultation is a review of MDNR surface water and sediment data only, not subsurface water (that is, groundwater).

As reported in the Annual Interim Measures Performance Monitoring Summary Report for 2002 (BP 2003), groundwater and soil gases are drawn through a suction tube by a vacuum truck for each EFR well event. Two 200-pound vapor-phase carbon vessels (in series) adsorb volatile emissions from the vacuum truck tank exhaust. During each EFR event, the ambient air and the air emitted from the carbon vessels were monitored for VOCs using a PID. The PIDs were read every 15 minutes to determine the length of time of each EFR event. In late 2001, the use of the PID on ambient air was discontinued, but the PID meter still monitors the air emitted from the carbon vessels. Please see Section 2.4.



Comment 13: You note, “*with the exceptions noted below, none of the detected metals, VOCs, or SVOCs, in the samples collected in the northern drainage areas were found at a level that exceeded health-based comparison values.*” The first questions ATSDR must ask is how often have these chemicals been tested for and in what areas? As we have said before, the chemicals list has been substantially limited. If a complete priority pollutants list had been used from the beginning, 18 years ago, we would not be doing this now. Only recently has methyl tertiary butyl ether (MTBE) been discovered in a residential well at Scarritt and Carlisle (off-site), and a seep on the north bluffs (on-site). ATSDR should require a complete sampling realm, at least quarterly. Without quarterly testing and QA/QC protocol descriptions, there is not enough information to decide if these chemicals are of no consequence.

Response 13: During the July 1999 sampling event, MTBE was detected below comparison values in one surface water sample collected from the northern drainage area. To determine whether the levels found in samples from the northern drainage area are truly representative, ATSDR recommended additional off-site sampling, which subsequently occurred. ATSDR reviewed the additional data and determined exposures are not at levels of public health concern (see Section 7).

Comment 14: Trespassers are not limited to adults. As we’ve stated before, children have admitted to us that they have trespassed. Therefore, any exposure levels calculated by ATSDR should take this into account.

Response 14: Comment noted. Surface water and sediment contaminant levels on-site are not of public health concern for young trespassers who may be intermittently exposed.

Comment 15: You note, “*additionally, these contaminants are not expected to migrate “upstream” through the surface water into the Norledge neighborhood.*” At this site, limestone and its fissures and cracks, both on the surface and underground, are a reality. This means that groundwater may migrate upwards, downwards, over, under, and/or around, to move. Also, if groundwater reaches a zone of saturation, it will choose the pathway of least resistance, creating “underground highways.” For example, sewers, pipelines, gas lines, water lines, foundations, etc.

Response 15: Sampling of surface water upstream did not detect contaminants at levels of health concern (see Section 7).

Comment 16: Table 1 in Appendix B should be clarified to indicate that the Amoco Former Refinery is not a likely source of contaminant detections in off-site upstream water

and sediments. In addition, Table 1 indicated that Amoco is the only source to on-site surface water and sediment. Other upstream sources also could contribute to constituents detected in on-site surface water and sediments.

Response 16: Table 1 was modified to indicate that the source of the contaminants in off-site upstream samples is “unknown,” and the source of contaminants in on-site samples is “Amoco and other sources.”

Comment 17: Sample #994116, called “sediment sample from the Norledge neighborhood,” is in fact, as we stated earlier, a sample *not* taken from near Norledge Avenue, but instead from several blocks away at Ohio and Carlisle. We find it extremely suspicious that you omitted these words from your report, particularly since the data you failed to review (i.e., in MDNR’s March 2000 report) clearly indicated that benzo(a)pyrene was found at excessive levels on BP Amoco’s refinery. You state that it is your “*suspicion that the source of the benzo(a)pyrene could have been residue from a previous fire or burning of brush along the creek bank.*” Is this fabrication similar to others indicating that the petroleum odors reported were coming from fires burning in New Mexico? Actually, it is against the law in Sugar Creek to have open-burning fires and has been for some time. It is our “suspicion” that any residue from a previous fire near the creek was due to the infamous Sugar Creek fire of 1966, when the creek actually caught on fire because of the refinery’s excessive dumping of flammable wastes. Could this have been it?

Response 17: This health consultation was modified to state the specific location of the sample—that it was taken near the intersection of Ohio and Carlisle streets. ATSDR evaluated MDNR’s March 2000 report in a health consultation (released in December 2000) and determined exposures are not expected to result in adverse health effects (see Section 7). The statement “suspicion that the source...” was deleted.

Comment 18: You note that “*Exposure to benzo(a)pyrene found in one sediment sample of the Norledge neighborhood area of Sugar Creek is not likely to cause adverse health effects. ATSDR determined that benzo(a)pyrene poses no apparent health hazard.*” You made an unequivocal statement here and need to be more careful. Such a statement is ridiculous, given the toxicity of this chemical and the limited samples you’ve discussed.

Response 18: ATSDR recommended additional sampling to determine whether this sample truly characterizes this off-site area. Additional data confirmed the conclusion that benzo(a)pyrene is not at levels of health concern in this off-site area (see Section 7).

Comment 19: We want to stress that compiling these reports individually, instead of presenting a comprehensive Public Health Assessment report, does not allow the average person to critically understand the gaps in the data. Each little report that is produced as an Addendum to the overall report is a misrepresentation when one cannot view the report as a whole.

Response 19: ATSDR's public health assessments and health consultations for Sugar Creek near the former Amoco refinery resulted directly from requests to ATSDR from a variety of entities to review specific data sets for public health significance. Although the first few reports found data gaps and recommended further sampling, each additional sampling event supported ATSDR's previous conclusions. All of the environmental data ATSDR has evaluated thus far indicate that current exposures to the detected levels of contaminants are not likely to result in adverse health effects (see Section 7).

Comment 20: We agree with your assessment that *"further characterization is needed to ensure that the reported levels are truly representative of current conditions."* However, we would have been more detailed in our recommendations for future efforts. Extensive air, soil, water, and sediment sampling should take place, at least quarterly, both on- and off-site. A one-sentence, ambiguous recommendation is unconscionable. One would think that your duty to protect the public's health would take precedence.

Response 20: The results of additional sampling of a variety of environmental media indicate that exposure to the detected levels of contaminants are not likely to result in adverse health effects (see Section 7). Because our conclusions have not changed on the basis of the additional data, ATSDR has updated the recommendation section of this health consultation to state "ATSDR has no specific recommendations at this time" (see Section 6).

## References:

[BP] BP Products of North America, Inc. 2003. Annual interim measures performance monitoring summary, 2002, BP Products North America, Inc., (a former Amoco Oil Company) regarding the former refinery at Sugar Creek, MO. Golden, CO: The RETEC Group, Inc; project number AMO61-16275-780.

[EPA] Environmental Protection Agency. 2001. March 12 e-mail with attachment (ATSDRQand A.wpd) sent by Robert Aston, EPA, to Denise Jordan-Izaguirre, ATSDR, containing EPA's responses to a list of questions ATSDR submitted about activities in the Norledge area of Sugar Creek. Kansas City, Kansas: EPA Region 7.

[EPA] Environmental Protection Agency. 2002. October 10 e-mail with attachment (atsdrquestions.wpd) sent by Robert Aston, EPA, to Denise Jordan-Izaguirre, ATSDR, regarding another list of questions ATSDR submitted about activities in the Norledge area of Sugar Creek. Kansas City, Kansas: EPA Region 7.